

We claim:

1. A transceiver for use in a communication system, comprising:

a transmitter for transmitting binary data, the transmitter being operative to encode data using a generalized low density parity check (LDPC) code whose variable nodes and check nodes are codes and which is designed to provide for successful decoding to convergence at a code rate near the capacity of a channel over which communication occurs; and

a receiver for receiving binary data transmitted using a generalized LDPC code, the receiver being operative to iteratively decode the data.

2. The transceiver of claim 1, wherein the generalized LDPC code is designed so as to closely match the information transfer properties of the variable nodes to those of the check nodes.

3. The transceiver of claim 2, wherein the generalized LDPC code is characterized by a variable node EXIT curve closely matched to and lying above a check node EXIT curve.

4. The transceiver of claim 3, wherein the generalized LDPC code is designed so that a relatively small area is enclosed between the variable node curve and the check node curve characterizing the code.

5. A transmitter for transmitting encoded binary data, comprising:

a data source for communicating a stream of data bits for transmission; and

an encoder for encoding the data bits, the encoder being operative to perform encoding according to a generalized LDPC code whose variable nodes and check nodes are codes and which is designed to provide for successful decoding to convergence at a code rate near the capacity of a channel over which communication occurs.

6. The transmitter of claim 5, wherein the generalized LDPC code is designed so as to closely match the information transfer properties of the variable nodes to those of the check nodes.

7. The transmitter of claim 6, wherein the generalized LDPC code is characterized by a variable node EXIT curve closely matched to and lying above a check node EXIT curve.

8. The transmitter of claim 7, wherein the generalized LDPC code is designed so that a relatively small area is enclosed between the variable node curve and the check node curve
5 characterizing the code.

9. A method of code design for a generalized LDPC code, comprising the steps of:
constructing a set of check nodes in the form of codes, the outputs of a check node being valid if the inputs to the check nodes are valid codewords of the code comprising the check node;
analyzing the information transfer properties of the check nodes;

10 designing a set of variable nodes having the form of codes, the outputs of a variable node being valid if the inputs to the variable node are valid codewords of the code comprising the variable node, the information transfer properties of the variable nodes being closely matched to those of the check nodes;

connecting the variable nodes to the check nodes with a set of interleaver edges such that
15 the generalized LDPC code provides a near capacity code rate and successful decoding to convergence; and

defining a set of codewords meeting the constraints imposed by the generalized LDPC code.

10. The method of claim 9, wherein the step of analyzing the information transfer
20 properties of the check nodes comprises plotting a check node EXIT curve reflecting the information transfer properties of the check nodes and the step of constructing the variable nodes comprises plotting a variable node EXIT curve reflecting the information transfer properties of the variable nodes and constructing variable nodes having the information transfer properties reflected by the variable node EXIT curve.

11. The method of claim 10, wherein the step of constructing the set of check nodes comprises forming an overall EXIT curve reflecting the combined properties of all types of check nodes in the set and repeatedly adjusting the properties of the check nodes and replotting the EXIT curve until the set of check nodes is characterized by an EXIT curve reflecting desired characteristics.

12. The method of claim 11, wherein the step of constructing the set of variable nodes includes choosing a set of variable node and connecting the variable nodes to the check nodes so as to produce desired characteristics for the set of variable nodes, plotting an overall EXIT curve reflecting the combined properties of all types of variable nodes in the set together with their connectivities and repeatedly adjusting the properties of the variable nodes and replotting the variable node EXIT curve until the set of variable nodes is characterized by an EXIT curve closely matched to the check node curve and otherwise reflecting desired characteristics for the variable nodes.